The invention claimed is:

1. A method for converting carbonaceous feedstock to alcohol comprising:

reforming feedstock into a first syngas stream comprising hydrogen, carbon dioxide and carbon monoxide;

separating the carbon dioxide from said first syngas stream, to yield a second syngas stream comprising hydrogen and carbon monoxide, from which carbon dioxide has been substantially removed;

passing said second syngas stream through a catalyzed reactor to produce alcohol;

diverting methane produced in said process to a methane reformer along with carbon dioxide, to produce carbon monoxide and hydrogen;

passing said hydrogen and carbon monoxide from said methane reformer through said catalyzed alcohol reactor.

2. The process of claim 1 in which methane produced in said process is allowed to recycle back through said alcohol reactor with unreacted hydrogen and carbon monoxide;

except that at least some of the time, at least a portion of said unreacted hydrogen, unreacted carbon monoxide and methane is diverted to said methane reformer.

3. The process of claim 2 in which said alcohol reactor is catalyzed to optimize ethanol production.

4. The process of claim 3 in which said catalyzed reactor is catalyzed by a catalyst consisting essentially of elemental cobalt as its primary constituent, with minor amounts of manganese, copper, zinc and one of chromium, aluminum and mixtures thereof.

5. The process of claim 4 in which the catalyst additionally includes an alkali or alkaline earth promoter.

6. The process of claim 5 in which the catalyst consists essentially of from about 65% to about 75% elemental cobalt, about 4% to about 12% manganese, about 4% to about 6% copper, about 4% to about 10% zinc, and about 6% to about 10% of one of chromium, aluminum or mixtures thereof.

7. The process of claim 4 in which said catalyst used consists essentially of from about 65% to about 75% elemental cobalt, about 4% to about 12% manganese, about 4% to about 6% copper, about 4% to about 10% zinc, and about 6% to about 10% of one of chromium, aluminum or mixtures thereof.

8. The process of claim 1 in which said catalyzed reactor is catalyzed by a catalyst consisting essentially of elemental cobalt as its primary constituent, with minor amounts of manganese, copper, zinc and one of chromium, aluminum and mixtures thereof.

9. The process of claim 8 in which the catalyst additionally includes an alkali or alkaline earth promoter.

10. The process of claim 9 in which the catalyst consists essentially of from about 65% to about 75% elemental cobalt, about 4% to about 12% manganese, about 4% to about 6% copper, about 4% to about 10% zinc, and about 6% to about 10% of one of chromium, aluminum or mixtures thereof.

11. The process of claim 8 in which said catalyst used consists essentially of from about 65% to about 75% elemental cobalt, about 4% to about 12% manganese, about 4% to about 6% copper, about 4% to about 10% zinc, and about 6% to about 10% of one of chromium, aluminum or mixtures thereof.

12. The process of claim 1 in which said step of reforming said carbonaceous feedstock is conducted at elevated temperature in a feedstock reformer, and includes adjusting the contact time of the syngas at elevated temperatures in the reformer, and adjusting the exit gas temperature of the syngas as it leaves the reformer, to achieve proportions of carbon monoxide, hydrogen and methane most closely approximating those desired given the intended use of the syngas.

13. The process of claim 12 which includes introducing said feedstock and superheated steam into the feedstock reformer at about 204° C. (400° F.);

adjusting said exit temperature of said syngas leaving said feedstock reformer to between about 871° C. (1600° F.) and about 1204° C. (2200° F.);

adjusting said contact time of said syngas within said reformer within a range of from about 0.4 seconds to about 5.0 seconds.

14. The process of claim 13 in which said syngas exit temperature and contact time are adjusted to produce a syngas most optimally proportioned to produce lower alcohols, by adjusting said syngas exit temperature to from about 898° C. (1650° F.) to about 926° C. (1700° F.), and said contact time from about 1.0 seconds to about 3.0 seconds.

15. The process of claim 14 in which said contact time is adjusted to from about 1.0 seconds to about 2.0 seconds.

16. The process of claim 13 in which said catalyzed reactor is catalyzed by a catalyst consisting essentially of elemental cobalt as its primary constituent, with minor amounts of manganese, copper, zinc and one of chromium, aluminum and mixtures thereof.

17. The process of claim 16 in which the catalyst additionally includes an alkali or alkaline earth promoter.

18. The process of claim 17 in which the catalyst consists essentially of from about 65% to about 75% elemental cobalt, about 4% to about 12% manganese, about 4% to about 6% copper, about 4% to about 10% zinc, and about 6% to about 10% of one of chromium, aluminum or mixtures thereof.

19. The process of claim 16 in which said catalyst used consists essentially of from about 65% to about 75% elemental cobalt, about 4% to about 12% manganese, about 4% to about 6% copper, about 4% to about 10% zinc, and about 6% to about 10% of one of chromium, aluminum or mixtures thereof.

20. The process of claim 12 in which said catalyzed reactor is catalyzed by a catalyst consisting essentially of elemental cobalt as its primary constituent, with minor amounts of manganese, copper, zinc and one of chromium, aluminum and mixtures thereof.

21. The process of claim 20 in which the catalyst additionally includes an alkali or alkaline earth promoter.

22. The process of claim 21 in which the catalyst consists essentially of from about 65% to about 75% elemental cobalt, about 4% to about 12% manganese, about 4% to about 6% copper, about 4% to about 10% zinc, and about 6% to about 10% of one of chromium, aluminum or mixtures thereof.

23. The process of claim 20 in which said catalyst used consists essentially of from about 65% to about 75% elemental cobalt, about 4% to about 12% manganese, about 4% to about 6% copper, about 4% to about 10% zinc, and about 6% to about 10% of one of chromium, aluminum or mixtures thereof.

24. The process of claim 1 in which said step of reforming feedstock into a first syngas stream includes:

comminuting the feedstock;

entraining the comminuted feedstock in a stream of inert gas and conveying it to a feed hopper where it is maintained in an inert gas environment;

metering the flow rate of feedstock into said reformer by a rotary valve through which the feedstock is fed, said rotary valve comprising a plurality of separate compartments which rotate from a valve inlet at which comminuted feedstock is fed into a valve compartment, to a valve outlet at which comminuted feedstock flows from said rotary valve;

feeding said feedstock through a feed conduit leading from said rotary valve outlet to a stream of steam under pressure into which the feedstock is fed and entrained;

feeding inert gas into said feed conduit under pressure, to prevent the steam under pressure from creating a back pressure in said feed conduit which would prevent comminuted feedstock from feeding into said stream of steam under pressure;

feeding inert gas under pressure into said rotary valve such that it pressurizes a compartment after it has passed said rotary valve inlet and before it has reached said rotary valve outlet whereby the comminuted feedstock contained in said compartment is maintained under pressure;

providing a vent in said rotary valve at a point between said outlet and said inlet, in the direction in which said compartments are rotated, such that a compartment under pressure which has been emptied at said outlet and is returning to said inlet will be vented of pressure introduced when said inert gas is fed into said compartment under pressure, before the emptied compartment reaches said rotary valve inlet;

feeding the steam entrained stream of comminuted feedstock to a feedstock reformer.

25. The process of 24 in which said comminuted feedstock is dried to a moisture content of from about 5% to about 20% before being fed into said feed hopper.

26. The process of claim 25 in which said feedstock is dried to a moisture content of from about 9% to about 15% before it is fed into said feed hopper.

27. The process of claim 26 in which said stream of inert gas comprises flue gas.

28. The process of claim 27 in which said flue gas is the exhaust gas from the carbonaceous feedstock reformer into which the comminuted feedstock and steam are fed.

29. The process of claim 24 in which said step of reforming said carbonaceous feedstock is conducted at elevated temperature in a feedstock reformer, and includes adjusting the contact time of the syngas at elevated temperatures in the reformer, and adjusting the exit gas temperature of the syngas as it leaves the reformer, to achieve proportions of carbon monoxide, hydrogen and methane most closely approximating those desired given the intended use of the syngas.

30. The process of claim 29 which includes introducing said feedstock and superheated steam into the feedstock reformer at about 204° C. (400° F.);

adjusting said exit temperature of said syngas leaving said feedstock reformer to between about 871° C. (1600° F.) and about 1204° C. (2200° F.);

adjusting said contact time of said syngas within said reformer within a range of from about 0.4 seconds to about 5.0 seconds.

31. The process of claim 30 in which said catalyzed reactor is catalyzed by a catalyst consisting essentially of elemental cobalt as its primary constituent, with minor amounts of manganese, copper, zinc and one of chromium, aluminum and mixtures thereof.

32. The process of claim 31 in which the catalyst additionally includes an alkali or alkaline earth promoter.

33. The process of claim 32 in which the catalyst consists essentially of from about 65% to about 75% elemental cobalt, about 4% to about 12% manganese, about 4% to about 6% copper, about 4% to about 10% zinc, and about 6% to about 10% of one of chromium, aluminum or mixtures thereof.

34. The process of claim 24 which includes introducing said feedstock and superheated steam into the feedstock reformer at about 204° C. (400° F.);

adjusting said exit temperature of said syngas leaving said feedstock reformer to between about 871° C. (1600° F.) and about 1204° C. (2200° F.);

adjusting said contact time of said syngas within said reformer within a range of from about 0.4 seconds to about 5.0 seconds.

35. The process of claim 34 in which said catalyzed reactor is catalyzed by a catalyst consisting essentially of elemental cobalt as its primary constituent, with minor amounts of manganese, copper, zinc and one of chromium, aluminum and mixtures thereof.

36. The process of claim 35 in which the catalyst additionally includes an alkali or alkaline earth promoter.

37. The process of claim 36 in which the catalyst consists essentially of from about 65% to about 75% elemental cobalt, about 4% to about 12% manganese, about 4% to

about 6% copper, about 4% to about 10% zinc, and about 6% to about 10% of one of chromium, aluminum or mixtures thereof.

38. The process of claim 1 in which a portion of said second syngas stream is diverted and used to run a turbine to generate electricity to power compressors and other electrically driven devices used in the process.

39. A catalyst consisting essentially of elemental cobalt as its primary constituent, with minor amounts of manganese, copper, zinc and one of chromium, aluminum and mixtures thereof.

40. The catalyst of claim 39 which additionally includes an alkali or alkaline earth promoter.

41. The catalyst of claim 40 consisting essentially of from about 65% to about 75% elemental cobalt, about 4% to about 12% manganese, about 4% to about 6% copper, about 4% to about 10% zinc, and about 6% to about 10% of one of chromium, aluminum or mixtures thereof.

42. The catalyst of claim 39 consisting essentially of from about 65% to about 75% elemental cobalt, about 4% to about 12% manganese, about 4% to about 6% copper, about 4% to about 10% zinc, and about 6% to about 10% of one of chromium, aluminum or mixtures thereof.

43. A catalyst made by mixing the salts of cobalt, manganese, zinc, copper, and one of chromium, aluminum and mixtures thereof, and an alkali or alkaline earth salt, in proportions such that the elemental content of cobalt, manganese, copper, zinc and one of chromium, aluminum and mixtures thereof, relative to one another is as follows:

from about 65% to about 75% elemental cobalt, about 4% to about 12% manganese, about 4% to about 6% copper, about 4% to about 10% zinc, and about 6% to about 10% of one of chromium, aluminum or mixtures thereof;

pelletizing the mixture, either by forming pellets of the mixture, or loading the mixture onto carbon pellets;

exposing the resulting pellets to a reducer doped inert gas at elevated temperature and pressure until the cobalt, manganese, copper, zinc and one of chromium, aluminum and mixtures of salts have been substantially reduced.

44. The catalyst of 43 in which said step of exposing the resulting pellets to a reducer doped inert gas at elevated temperature and pressure comprises:

preheating an inert gas doped with a small amount of hydrogen to a temperature of about 200° C., and exposing said pellets to a reducer doped inert gas under a pressure of about 172 kilopascals (KPa) (25 pounds per square inch (psig)) to about 207 kilopascals (KPa) (30 pounds per square inch (psig)), causing said pellets to heat to about 400° C.;

measuring the pellet temperature and the gas temperature, and as the pellet and gas temperature fall off, introducing additional amounts of hydrogen into the gas stream, building over time to a level of from about 25% to about 30% hydrogen;

gradually increasing pressure over time until it reaches from about 8273 KPa (1200 psig) to about 16,547 KPa (2400 (psig));

after additional hydrogen ceases to be effective in maintaining the pellet and gas temperature, gradually adding carbon monoxide to the reducer doped stream of inert gas, and continuing such addition until the pellet temperature and gas temperature continue to fall in spite of the incremental addition of carbon monoxide;

cooling the pellets and storing them under an inert gas purge until they are ready for use.

45. A method for controlling the proportions of carbon monoxide, hydrogen and methane in a syngas stream leaving a feedstock reformer, in which feedstock is introduced into time an elevated temperature reformer, said process comprising:

adjusting the contact time of the syngas at elevated temperatures in the reformer, and adjusting the exit gas temperature of the syngas as it leaves the reformer, to achieve proportions of carbon monoxide, hydrogen and methane most closely approximate those desired given the intended use of the syngas.

46. The process of claim 45 which includes introducing said feedstock and superheated steam into the feedstock reformer at about 204° C. (400° F.);

adjusting said exit temperature of said syngas leaving said feedstock reformer to between about 871° C. (1600° F.) and about 1204° C. (2200° F.);

adjusting said contact time of said syngas within said reformer within a range of from about 0.4 seconds to about 5.0 seconds.

47. The process of claim 46 in which said syngas exit temperature and contact time are adjusted to produce a syngas most optimally proportioned to produce lower alcohols, by adjusting said syngas exit temperature to from about 898° C. (1650° F.) to about 926° C. (1700° F.), and said contact time from about 1.0 seconds to about 3.0 seconds.

48. The process of claim 47 in which said contact time is adjusted to from about 1.4 seconds to about 2.0 seconds.

49. A process for converting carbonaceous feedstock to syngas comprising:

comminuting the feedstock;

entraining the comminuted feedstock in a stream of inert gas and conveying it to a feed hopper where it is maintained in an inert gas environment;

metering the flow rate of feedstock into said reformer by a rotary valve through which the feedstock is fed, said rotary valve comprising a plurality of separate compartments which rotate from a valve inlet at which comminuted feedstock is fed into a valve compartment, to a valve outlet at which comminuted feedstock flows from said rotary valve;

feeding said feedstock through a feed conduit leading from said rotary valve outlet to a stream of steam under pressure into which the feedstock is fed and entrained;

feeding inert gas into said feed conduit under pressure, to prevent the steam under pressure from creating a back pressure in said feed conduit which would prevent comminuted feedstock from feeding into said stream of steam under pressure;

feeding inert gas under pressure into said rotary valve such that it pressurizes a compartment after it has passed said rotary valve inlet and before it has reached said rotary valve outlet whereby the comminuted feedstock contained in said compartment is maintained under pressure;

providing a vent in said rotary valve at a point between said outlet and said inlet, in the direction in which said compartments are rotated, such that a compartment under

pressure which has been emptied at said outlet and is returning to said inlet will be vented of pressure introduced when said inert gas is fed into said compartment under pressure, before the emptied compartment reaches said rotary valve inlet;

feeding the steam entrained stream of comminuted feedstock to a feedstock reformer.

50. The process of 49 in which said comminuted feedstock is dried to a moisture content of from about 5% to about 20% before being fed into said feed hopper.

51. The process of claim 50 in which said feedstock is dried to a moisture content of from about 9% to about 15% before it is fed into said feed hopper.

52. The process of claim 49 in which said stream of inert gas comprises flue gas.

53. The process of claim 52 in which said flue gas is the exhaust gas from the carbonaceous feedstock reformer into which the comminuted feedstock and steam are fed.

54. The apparatus for handling comminuted carbonaceous feedstock comprising a hopper for holding feedstock; a rotary valve through which the feedstock is fed, said rotary valve comprising a plurality of separate compartments which rotate from a valve inlet at which comminuted feedstock is fed into a valve compartment, to a valve outlet at which comminuted feedstock flows from said rotary valve;

a feed conduit leading from said rotary valve outlet to a conduit for stream of steam under pressure into which the feedstock is fed and entrained;

a feed conduit for feeding inert gas into said feed conduit under pressure, to prevent the steam under pressure from creating a back pressure in said feed conduit which would prevent comminuted feedstock from feeding into said stream of steam under pressure;

a second feed conduit for feeding inert gas under pressure into said rotary valve such that it pressurizes a compartment after it has passed said rotary valve inlet and before it has reached said rotary valve outlet whereby the comminuted feedstock contained in said compartment is maintained under pressure;

there being a vent in said rotary valve at a point between said outlet and said inlet, in the direction in which said compartments are rotated, such that a compartment under pressure which has been emptied at said outlet and is returning to said inlet will be vented of pressure introduced when said inert gas is fed into said compartment under pressure, before the emptied compartment reaches said rotary valve inlet.

55. An apparatus comprising:

a carbonaceous feedstock reformer for generating syngas;

first conduit defining a flow path through which syngas flows;

a carbon dioxide separator located in said flow path downstream from said feedstock reformer;

an alcohol catalyzed reactor located in said flow path downstream from said carbon dioxide separator;

a gas separator for separating gas from liquid exiting said alcohol catalyzed reactor;

a methane reformer, and a second conduit connecting said gas separator to said methane reformer, whereby the gas stream and any methane therein, which is separated from liquid at said gas separator, is conveyed to said methane reformer;

a third conduit connecting said carbon dioxide separator to said methane reformer, whereby methane in said gas stream can be reacted with carbon dioxide to form carbon monoxide and hydrogen;

a fourth conduit connecting said methane reformer to one of said first conduit and said alcohol reactor.

56. The apparatus of claim 55 in which a fifth conduit extends from said gas separator back to said alcohol reactor for recycling said gas stream; and a diverter valve between said fourth and fifth conduit which is activated from time to time to divert gas from said fifth conduit to said fourth conduit.

57. The apparatus of claim 56 which includes a meter in said fifth conduit for measuring the methane content of gas therein; said diverter valve being operably connected to said meter, and operating in response to said meter sensing a particular level of methane to divert said gas to said fourth conduit.